

WHAT IS CLAIMED IS:

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1. A multi-layered thermoplastic container comprising
- a first polymeric layer comprising an alkylene terephthalate or naphthalate polymer;
 - a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, a glycidyl acrylate, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; and
 - a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

2. The container of claim 1 wherein said first polymeric layer is selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

3. The container of claim 1 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

4. The container of claim 1 wherein said second intermediate layer is selected from the group consisting of ethylene/glycidyl methacrylate co-polymer, ethylene/glycidyl methacrylate/methacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylacrylate ter-polymer, ethylene/glycidyl methacrylate/butylacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylhexylacrylate ter-polymer, and mixtures thereof.

5. The container of claim 4 wherein said second intermediate layer comprises a grafted co-polymer or ter-polymer.

6. The container of claim 4 wherein said second intermediate layer comprises a blend of (i) said co-polymer or ter-polymer and (ii) a co-polymer of ethylene and a C₁-C₁₂ acrylate.

7. The container of claim 1 wherein said second intermediate layer comprises a co-polymer or ter-polymer having from 0 to about 40 wt% of said acrylate and from about 0.05 to about 12 wt% of said glycidyl acrylate, based on a total weight of the co-polymer or ter-polymer.

8. The container of claim 7 wherein said second intermediate layer comprises a ter-polymer having from about 10 wt% to about 40 wt% of said acrylate.

9. The container of claim 7 wherein said co-polymer or ter-polymer has from about 0.1 wt% to about 10 wt% of said glycidyl acrylate.

10. The container of claim 1 wherein said third polymeric layer consists essentially of high density polyethylene.

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11. The container of claim 1 wherein said ~~alkylene terephthalate or naphthalate~~ polymer has a degree of crystallinity of at least about 15%.

12. The container of claim 1 wherein said alkylene terephthalate or naphthalate polymer has a degree of crystallinity of less than about 15%.

13. A multi-layered thermoplastic container comprising:
a first polymeric layer comprising an alkylene terephthalate or naphthalate polymer;

a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, maleic anhydride, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

14. The container of claim 13 wherein said first polymeric layer is selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

15. The container of claim 13 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polyesters, or a mixture thereof.

16. The container of claim 13 wherein said second intermediate layer is selected from the group consisting of ethylene/maleic anhydride co-polymer, ethylene/maleic anhydride/methacrylate ter-polymer, ethylene/maleic anhydride/ethylacrylate ter-polymer, ethylene/maleic anhydride/butylacrylate ter-polymer, ethylene/maleic anhydride/ethylhexylacrylate ter-polymer, and mixtures thereof.

17. The container of claim 16 wherein said second intermediate layer comprises a grafted co-polymer or ter-polymer.

18. The container of claim 16 wherein said second intermediate layer comprises a blend of (i) said co-polymer or ter-polymer and (ii) a co-polymer of ethylene and a C₁-C₁₂ acrylate.

19. The container of claim 13 wherein said second intermediate layer comprises a co-polymer or ter-polymer having from 0 to about 40 wt% of said acrylate and from about 0.05 to about 12 wt% of said maleic anhydride, based on a total weight of the co-polymer or ter-polymer.

20. The container of claim 19 wherein said second intermediate layer comprises a ter-polymer having from about 10 wt% to about 30 wt% of said acrylate.

21. The container of claim 19 wherein said co-polymer or ter-polymer has from about 0.1 wt% to about 10 wt% of said maleic anhydride.

22. A multi-layered thermoplastic container comprising:

a first polymeric layer comprising a polyethylene terephthalate homopolymer, a polyethylene terephthalate co-polymer, or a blend thereof; said first polymeric layer having an average thickness of from about 5 to about 35 mils;

a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, a glycidyl acrylate, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; said second intermediate layer having an average thickness of from about 0.1 to about 2 mils; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof; said third polymeric layer having an average thickness of from about 1 to about 5 mils;

wherein said container has an area stretch ratio of from about 1.5:1 to about 3:1.

23. The container of claim 22 wherein said second intermediate layer is selected from the group consisting of ethylene/glycidyl methacrylate co-polymer, ethylene/glycidyl methacrylate/methacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylacrylate ter-polymer, ethylene/glycidyl methacrylate/butylacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylhexylacrylate ter-polymer, and mixtures thereof.

24. The container of claim 22 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

25. The container of claim 24 wherein said first polymeric layer consists essentially of a polyethylene terephthalate co-polymer.

26. The container of claim 22 wherein said third polymeric layer consists essentially of high density polyethylene.

27. The container of claim 22 wherein said first polymeric layer has an average thickness of from about 10 to about 20 mils.

28. The container of claim 22 wherein said second intermediate layer has an average thickness of from about 0.2 to about 1.5 mils.

29. The container of claim 22 wherein said third polymeric layer has an average thickness of from about 2 to about 4 mils.

30. A multi-layered thermoplastic container comprising:

a first polymeric layer comprising a polyethylene terephthalate homopolymer, a polyethylene terephthalate co-polymer, or a blend thereof; said first polymeric layer having an average thickness of from about 5 to about 35 mils;

a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, maleic anhydride, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; said second intermediate layer having an average thickness of from about 0.1 to about 2 mils; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof; said third polymeric layer having an average thickness of from about 1 to about 5 mils;

wherein said container has an area stretch ratio of from about 1.5:1 to about 3:1.

31. The container of claim 30 wherein said second intermediate layer is selected from the group consisting of ethylene/maleic anhydride co-polymer, ethylene/maleic anhydride/methacrylate ter-polymer, ethylene/maleic anhydride/ethylacrylate ter-polymer, ethylene/maleic anhydride/butylacrylate ter-polymer, ethylene/maleic anhydride/ethylhexylacrylate ter-polymer, and mixtures thereof.

32. The container of claim 30 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

33. The container of claim 32 wherein said first polymeric layer consists essentially of a polyethylene terephthalate co-polymer.

34. The container of claim 30 wherein said third polymeric layer consists essentially of high density polyethylene.

35. The container of claim 30 wherein said first polymeric layer has an average thickness of from about 10 to about 20 mils.

36. The container of claim 30 wherein said second intermediate layer has an average thickness of from about 0.2 to about 1.5 mils.

37. The container of claim 30 wherein said third polymeric layer has an average thickness of from about 2 to about 4 mils.

Sub C4 38. A multi-layered thermoplastic container comprising:
a first polymeric layer comprising a polyethylene terephthalate homo-polymer, a polyethylene terephthalate co-polymer, or a blend thereof; said first polymeric layer having an average thickness of from about 12 to about 18 mils;
a second intermediate layer selected from the group consisting of ethylene/glycidyl methacrylate co-polymer, ethylene/maleic anhydride co-polymer,

ethylene/glycidyl methacrylate/methacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylacrylate ter-polymer, ethylene/glycidyl methacrylate/butylacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylhexylacrylate ter-polymer, ethylene/maleic anhydride/methacrylate ter-polymer, ethylene/maleic anhydride/ethylacrylate ter-polymer, ethylene/maleic anhydride/butylacrylate ter-polymer, ethylene/maleic anhydride/ethylhexylacrylate ter-polymer, and mixtures thereof; said second intermediate layer having an average thickness of from about 0.1 to about 1.5 mils; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof; said third polymeric layer having an average thickness of from about 2 to about 4 mils;

wherein said container has an area stretch ratio of from about 1.5:1 to about 3:1.

39. A multi-layered thermoplastic food container comprising:

a first polymeric layer comprising an alkylene terephthalate or naphthalate polymer;

a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, a glycidyl acrylate, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

40. The food container of claim 39 wherein said first polymeric layer is selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

41. The food container of claim 39 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

42. The food container of claim 39 wherein said second intermediate layer is selected from the group consisting of ethylene/glycidyl methacrylate co-polymer, ethylene/glycidyl methacrylate/methacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylacrylate ter-polymer, ethylene/glycidyl methacrylate/butylacrylate ter-polymer, ethylene/glycidyl methacrylate/ethylhexylacrylate ter-polymer, and mixtures thereof.

43. The food container of claim 42 wherein said second intermediate layer comprises a grafted co-polymer or ter-polymer.

44. The food container of claim 42 wherein said second intermediate layer comprises a blend of (i) said co-polymer or ter-polymer and (ii) a co-polymer of ethylene and an acrylate.

45. The food container of claim 39 wherein said first polymeric layer is visibly distorted when the container is filled with food and is exposed to microwave radiation.

46. The food container of claim 39, wherein said first polymeric layer is heat set and wherein said container is suitable for cooking in a microwave oven.

47. The food container of claim 39, wherein said container contains foodstuff and is sealed with highly elastic polyethylene-based lidding stock using modified atmosphere packaging.

48. / A multi-layered thermoplastic food container comprising:

a first polymeric layer comprising an alkylene terephthalate or naphthalate polymer;

a second intermediate layer comprising a grafted or backbone co-polymer or ter-polymer of ethylene, maleic anhydride, and optionally an acrylate selected from

the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

49. The food container of claim 48 wherein said first polymeric layer is selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

50. The food container of claim 48 wherein said first polymeric layer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

51. The food container of claim 48 wherein said second intermediate layer is selected from the group consisting of ethylene/maleic anhydride co-polymer, ethylene/maleic anhydride/methacrylate ter-polymer, ethylene/maleic anhydride/ethylacrylate ter-polymer, ethylene/maleic anhydride/butylacrylate ter-polymer, ethylene/maleic anhydride/ethylhexylacrylate ter-polymer, and mixtures thereof.

52. The food container of claim 48 wherein said second intermediate layer comprises a grafted co-polymer or ter-polymer.

53. The food container of claim 48 wherein said second intermediate layer comprises a blend of (i) said co-polymer or ter-polymer and (ii) a co-polymer of ethylene and an acrylate.

54. The food container of claim 48 wherein said first polymeric layer is visibly distorted when the container is filled with food and is exposed to microwave radiation.

55. The food container of claim 48, wherein said first polymeric layer is heat set and wherein said container is suitable for cooking in a microwave oven.

56. The food container of claim 48, wherein said container contains foodstuff and is sealed with highly elastic polyethylene-based lidding stock using modified atmosphere packaging.

57. A multi-layered thermoplastic container comprising:

a first polymeric layer comprising a major portion of an alkylene terephthalate or naphthalate polymer and a minor portion of a compatibilizer/emulsifier/surfactant (CES) comprising a grafted or backbone co-polymer or ter-polymer of ethylene, a glycidyl acrylate, and optionally an acrylate selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof;

an intermediate adhesive layer comprising modified polyethylene; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

58. The container of claim 57 wherein said first polymeric layer comprises a polyester selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

59. The container of claim 57 wherein said first alkylene terephthalate or naphthalate polymer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polymers, or a mixture thereof.

60. The container of claim 57 wherein said CES is selected from the group consisting of ethylene/glycidyl methacrylate co-polymer, ethylene/glycidyl methacrylate/methacrylate ter-polymer, ethylene/ glycidyl methacrylate/ ethylacrylate ter-polymer, ethylene/glycidyl methacrylate/ butylacrylate ter-

polymer, ethylene/glycidyl methacrylate/ ethylhexylacrylate ter-polymer, and mixtures thereof.

61. The container of claim 60 wherein said CES comprises a grafted co-polymer or ter-polymer.

62. The container of claim 59 wherein said CES comprises a co-polymer or ter-polymer having from 0 to about 40 wt% of said acrylate and from about 0.05 to about 12 wt% of said glycidyl acrylate, based on a total weight of the co-polymer or ter-polymer.

63. The container of claim 62 wherein said CES comprises a ter-polymer having from about 10 wt% to about 40 wt% of said acrylate.

64. The container of claim 62 wherein said co-polymer or ter-polymer has from about 0.1 wt% to about 10 wt% of said glycidyl acrylate.

65. The container of claim 59 wherein said third polymeric layer consists essentially of high density polyethylene.

66. The container of claim 59 wherein said alkylene terephthalate or naphthalate polymer has a degree of crystallinity of at least about 15%.

67. The container of claim 59 wherein said alkylene terephthalate or naphthalate polymer has a degree of crystallinity of less than about 15%.

68. A multi-layered thermoplastic container comprising:
a first polymeric layer comprising a major portion of an alkylene terephthalate or naphthalate polymer and a minor portion of a compatibilizer/emulsifier/surfactant (CES) comprising a grafted or backbone co-polymer or ter-polymer of ethylene, maleic anhydride, and optionally an acrylate

selected from the group consisting of methacrylate, ethylacrylate, propylacrylate, butylacrylate, ethylhexylacrylate, and mixtures thereof;

an intermediate adhesive layer comprising modified polyethylene; and

a third polymeric layer comprising high density polyethylene, low density polyethylene, linear low density polyethylene, or a blend thereof.

69. The container of claim 68 wherein said alkylene terephthalate or naphthalate polymer is selected from the group consisting of PET, PEN, PETG, PCT, PCTA, PBT, PTT, and mixtures thereof.

70. The container of claim 68 wherein said alkylene terephthalate or naphthalate polymer comprises one or more optionally branched homo-polymers, co-polymers, reprocessed polymers, recycled polyesters, or a mixture thereof.

71. The container of claim 68 wherein said CES is selected from the group consisting of ethylene/maleic anhydride co-polymer, ethylene/maleic anhydride/methacrylate ter-polymer, ethylene/maleic anhydride/ethylacrylate ter-polymer, ethylene/maleic anhydride/butylacrylate ter-polymer, ethylene/maleic anhydride/ethylhexylacrylate ter-polymer, and mixtures thereof.

72. The container of claim 71 wherein said CES comprises a grafted co-polymer or ter-polymer.

73. The container of claim 68 wherein said CES comprises a co-polymer or ter-polymer having from 0 to about 40 wt% of said acrylate and from about 0.05 to about 12 wt% of said maleic anhydride, based on a total weight of the co-polymer or ter-polymer.

74. The container of claim 73 wherein said CES comprises a ter-polymer having from about 10 wt% to about 30 wt% of said acrylate.

75. The container of claim 74 wherein said co-polymer or ter-polymer has from about 1 wt% to about 10 wt% of said maleic anhydride.

76. The container of claim 57 wherein said first layer comprises from about 1 to about 5 wt% of said CES.

77. The container of claim 68 wherein said first layer comprises from about 1 to about 5 wt% of said CES.

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